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FLOOD INSURANCE STUDY

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ORIGINAL

**TOWN OF
RISING SUN,
MARYLAND
CECIL COUNTY**



MAY 15, 1986



Federal Emergency Management Agency

COMMUNITY NUMBER - 240158

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
TOWN OF RISING SUN, MARYLAND

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Rising Sun, Cecil County, Maryland, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Rising Sun to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

This Flood Insurance Study was prepared by compiling pertinent information for the flood hazard areas in the Town of Rising Sun from existing technical and/or scientific data originally prepared by others for purposes other than the preparation of this study. This existing data was reviewed by FEMA prior to its use in the development of this Flood Insurance Study to ensure compliance with National Flood Insurance Program (NFIP) accuracy requirements.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the Maryland Water Resources Administration, Flood Management Division, during the course of the Flood Insurance Study for Cecil County. The Cecil County study was completed in June 1980.

1.3 Coordination

On June 13, 1985, the results of the study were reviewed at a final CCO meeting attended by representatives of FEMA and the Town of Rising Sun.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Rising Sun, Cecil County, Maryland. The area of study is shown on the Vicinity Map (Figure 1).

Stone Run Tributary 1 was studied by detailed methods for its entire length within the corporate limits. Stone Run Tributary 2 was studied by detailed methods from the downstream corporate limits to a point approximately 130 feet upstream of State Route 273. The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data.

Stone Run and the remaining portion of Stone Run Tributary 2 were studied by approximate methods. Approximate methods of analysis were used to study all remaining areas having a potential flood hazard that did not have available scientific or technical data.

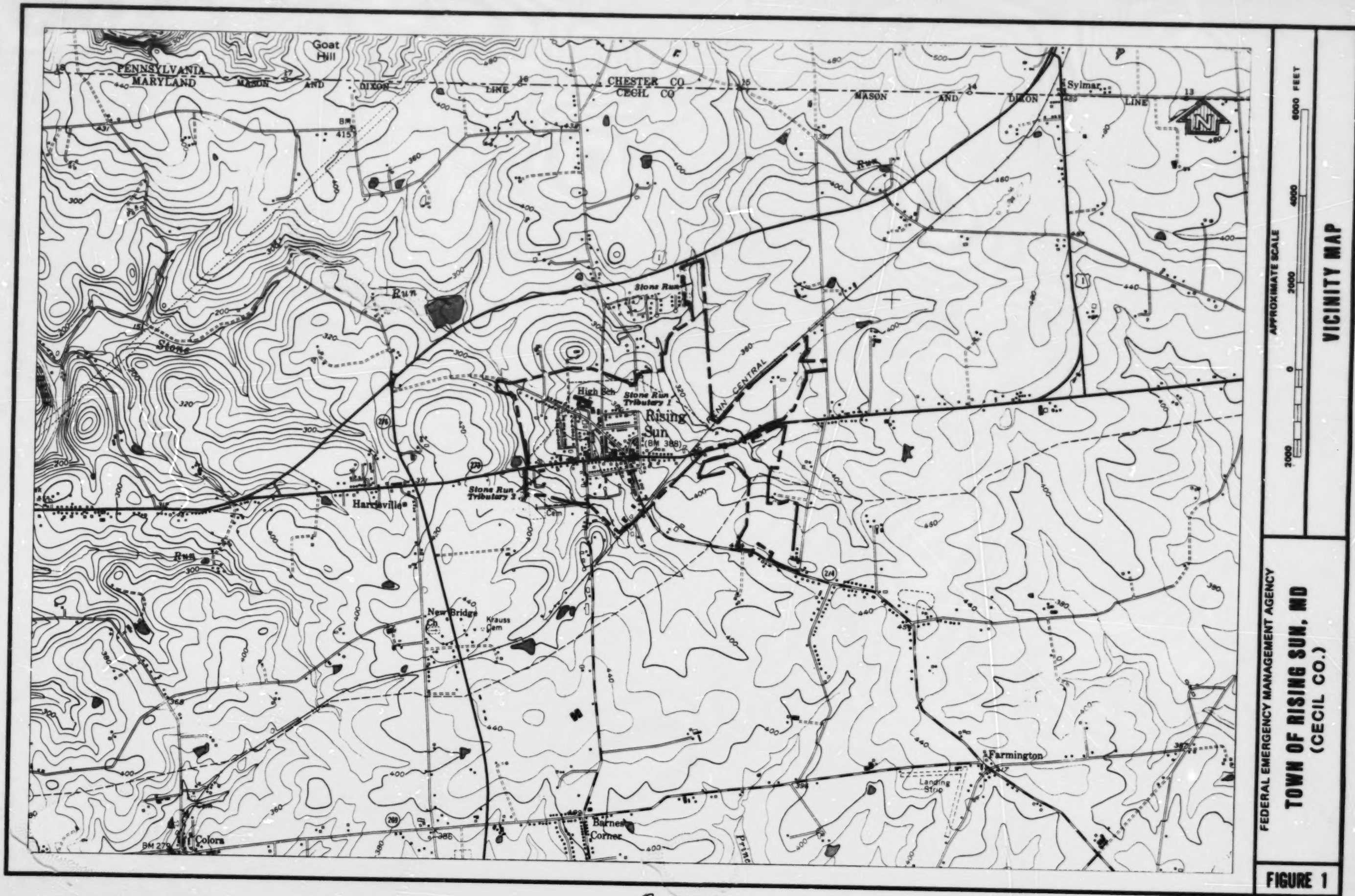
2.2 Community Description

The Town of Rising Sun is located in the northwestern corner of Cecil County in northeastern Maryland. It is completely surrounded by the unincorporated areas of Cecil County.

Rising Sun is situated in the piedmont section of Maryland. Seasons are well defined due to the presence of the Atlantic Ocean, the Chesapeake Bay, and the mountainous areas to the west. The average January temperature is 29.8 degrees Fahrenheit (°F); the average July temperature is 75.8°F.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special



significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Discharges for Stone Run Tributary 1 and Stone Run Tributary 2 were obtained from the Flood Insurance Study for Cecil County (Reference 1). In that study, peak discharge-frequency relationships were determined using two streamflow gages, Northeast Creek at Leslie and Big Elk Creek at Elk Mills. The lengths of record for the gages were 45 and 30 years, respectively. This information was applied to a multiple regression formula using log-Pearson Type III flood-frequency analyses (Reference 2). Results were checked with high-water marks and graphed with respect to drainage area and discharge, and utilized in the detailed flooding computer models.

The Soil Conservation Service (SCS) TR-20 computer program was employed to generate additional peak discharge-frequency relationships for smaller watersheds (Reference 3). Runoff curve numbers, drainage areas, and times of concentration for each watershed portion were developed for input in this model. Results were recorded in conjunction with the aforementioned graph to provide further accuracy on the lower end of the curve for small drainage areas.

A summary of drainage area-peak discharge relationships for Stone Run Tributary 1 and Stone Run Tributary 2 is shown in Table 1, "Summary of Discharges."

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA</u>	<u>PEAK DISCHARGES (cfs)</u>			
	<u>(sq. miles)</u>	<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
STONE RUN TRIBUTARY 1					
At its confluence with Stone Run	4.7	2,200	3,220	3,960	6,330
STONE RUN TRIBUTARY 2					
At its confluence with Stone Run	1.7	1,010	1,500	1,850	2,980

Input data for the backwater analyses were developed from field surveys. Cross sections were located at various intervals throughout the stream length to present an accurate representation of cross-sectional geometry. Cross sections were surveyed directly above and below bridges, dams, and culverts in order to compute backwater effects from these structures.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the U. S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 4). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Stone Run Tributary 1 were taken from elevations computed in the SCS TR-20 computer program (Reference 3). Starting water-surface elevations for Stone Run Tributary 2 were determined assuming coincident peak flows with Stone Run Tributary 1.

Roughness coefficients (Manning's "n") used in the hydraulic computations were estimated by field inspection of each cross section. The channel "n" values for Stone Run Tributary 1 ranged from 0.045 to 0.060, and the overbank "n" values ranged from 0.040 to 0.150. The channel "n" values for Stone Run Tributary 2 ranged from 0.045 to 0.065, and the overbank "n" values ranged from 0.012 to 0.070.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (References 5 and 6).

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated using the Flood Hazard Boundary Map for Rising Sun (Reference 7).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be

kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway widths for Stone Run Tributary 1 and Stone Run Tributary 2 extend beyond the corporate limits.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the Town of Rising Sun.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Stone Run Tributary 1								
A	5,253	193 ²	625	3.0	314.6	314.6	314.9	0.3
B	6,173	124	378	5.0	317.9	317.9	318.7	0.8
C	7,103	113	356	5.3	326.6	326.6	326.8	0.2
D	7,973	141	587	3.2	338.4	338.4	338.5	0.1
E	8,323	220	1,144	1.6	342.9	342.9	343.1	0.2
Stone Run Tributary 2								
A	814	115	511	3.6	283.8	283.8	283.8	0.0
B	2,704	174 ²	524	3.5	307.9	307.9	308.3	0.4
C	2,984	284	551	3.4	310.8	310.8	310.9	0.1

¹Feet above confluence with Stone Run

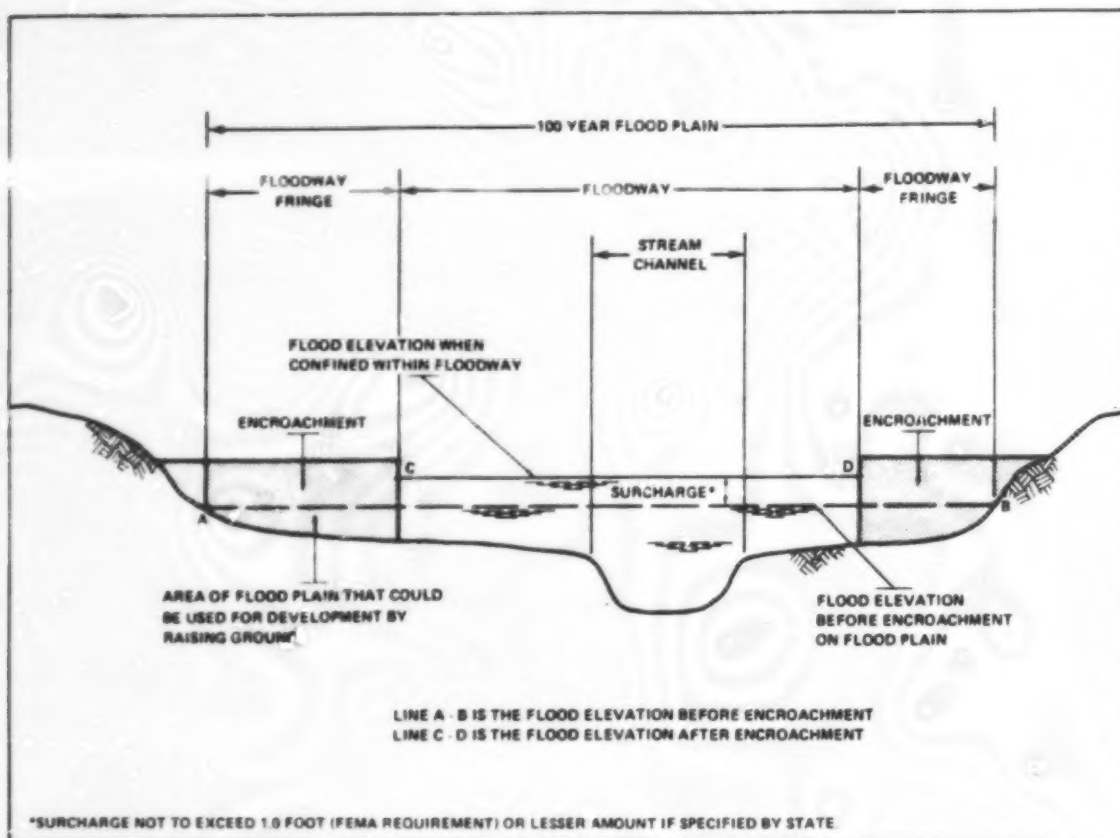
²This width extends beyond corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
TOWN OF RISING SUN, MD
(CECIL CO.)

FLOODWAY DATA

STONE RUN TRIBUTARY 1 - STONE RUN TRIBUTARY 2



FLOODWAY SCHEMATIC

Figure 2

Average Difference Between
10- and 100-Year Floods

Variation

Less than 2 feet

0.5 foot

2 to 7 feet

1.0 foot

7.1 to 12 feet

2.0 feet

More than 12 feet

3.0 feet

The locations of the reaches determined for the flooding sources of the Town of Rising Sun are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION ³ (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Stone Run Tributary 1							
Reach 1	01	-1.2	-0.5	+1.2	010	A2	Varies
Reach 2	01	-2.0	-0.9	+2.8	020	A4	Varies
Stone Run Tributary 2							
Reach 1	01	-1.2	-0.6	+1.2	010	A2	Varies

¹Flood Insurance Rate Map Panel²Weighted Average³Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF RISING SUN, MD

(CECIL CO.)

FLOOD INSURANCE ZONE DATA

STONE RUN TRIBUTARY 1 - STONE RUN TRIBUTARY 2

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

- Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHF's determined.
- Zones A2 and A4: Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHF's.
- Zone B: Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
- Zone C: Areas of minimal flooding; not subdivided.

Flood elevation differences, FHF's, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Rising Sun is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the

expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by organizations originally for purposes other than the preparation of this study. The data was identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the NFIP. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, Federal Emergency Management Agency (Regional Director, Region III Office, Curtis Building, Room 700, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106) for consideration for revision of this study.

The Flood Insurance Study for Cecil County has been completed (Reference 1). The results of this study are in exact agreement with the results of that study.

A Flood Hazard Boundary Map has been published for the Town of Rising Sun (Reference 7). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

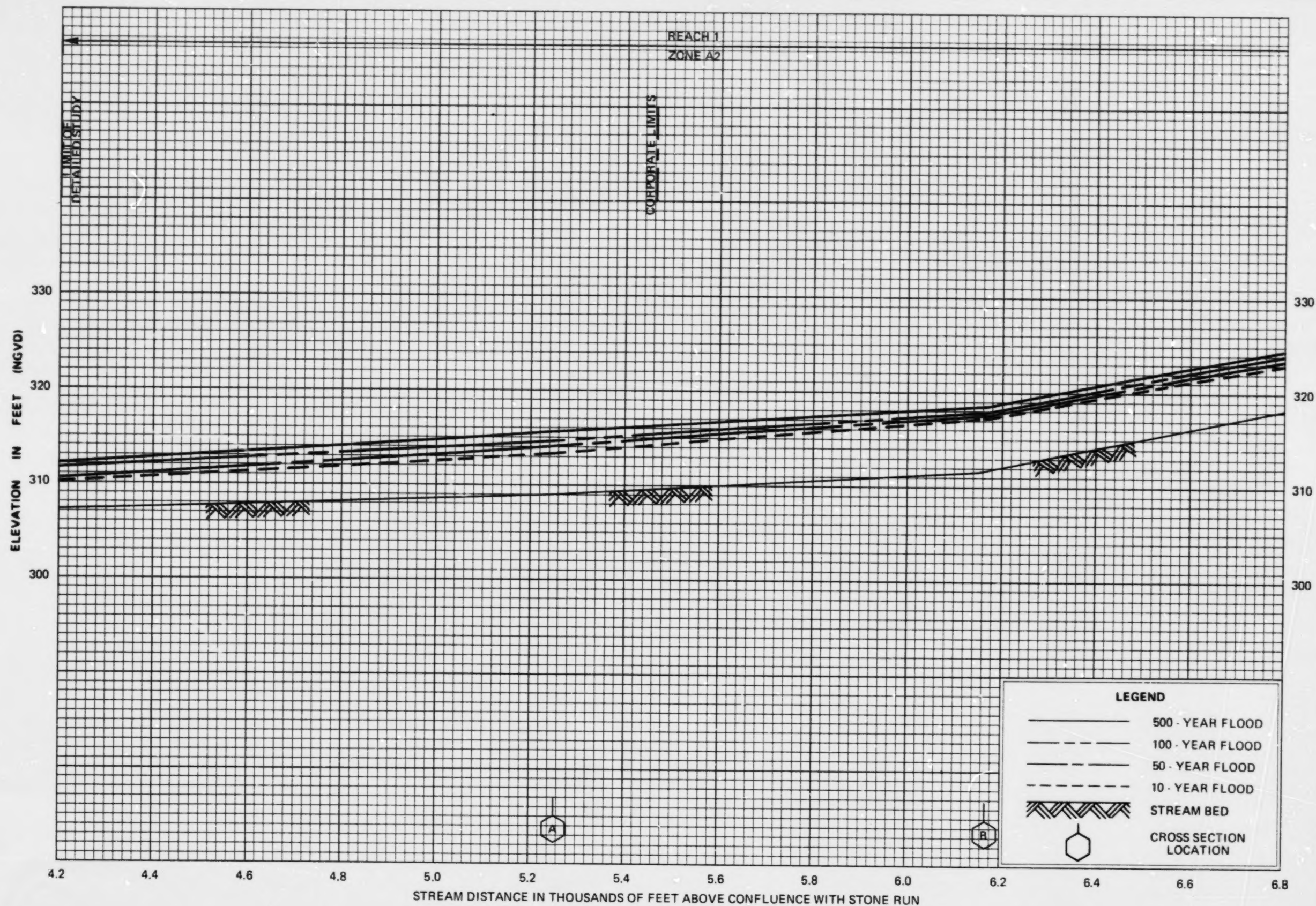
This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Room 700, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

8.0 BIBLIOGRAPHY AND REFERENCES

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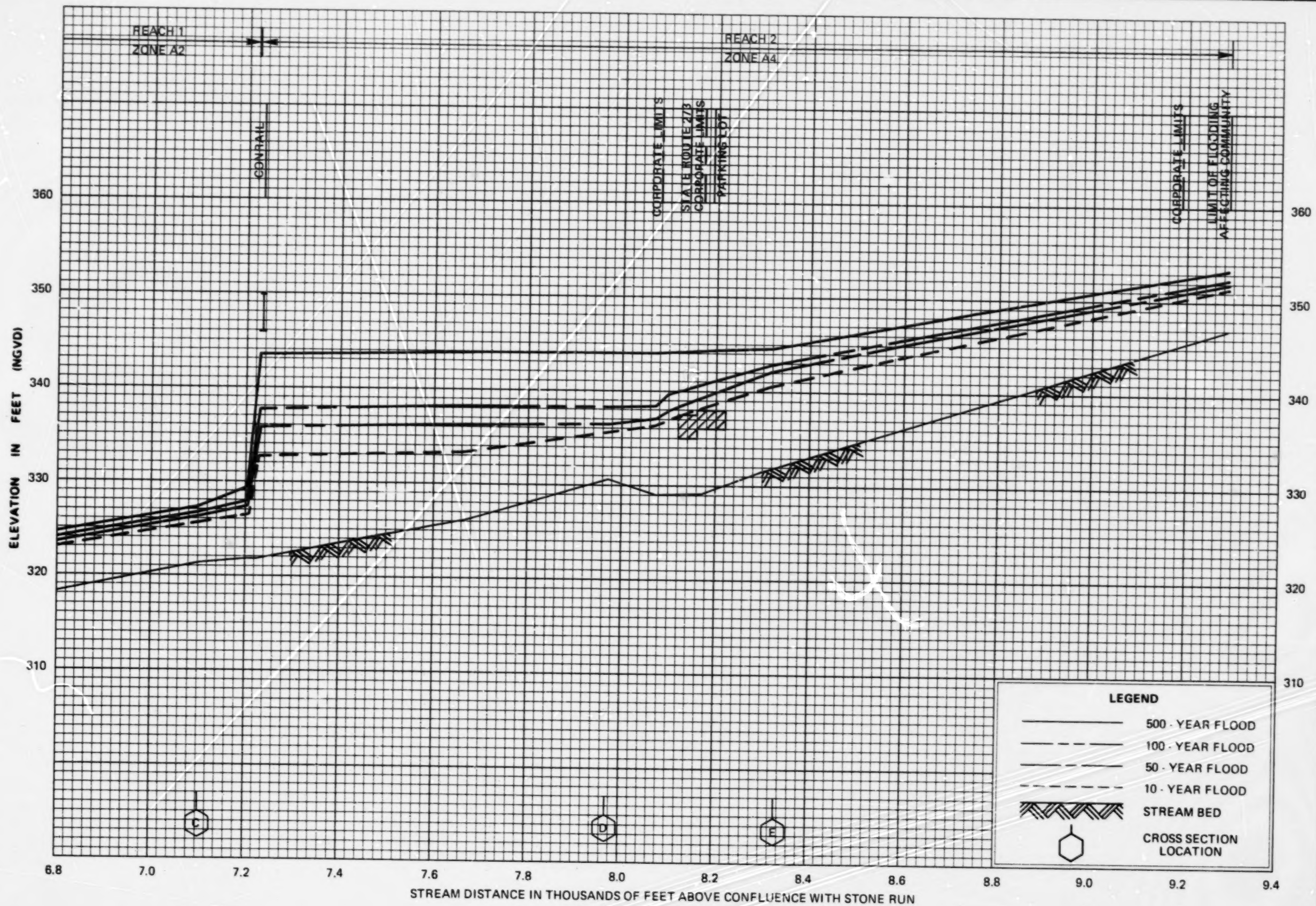


FLOOD PROFILES

STONE RUN TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
TOWN OF RISING SUN, MD
 (CECIL CO.)

01P



FLOOD PROFILES

STONE RUN TRIBUTARY 1

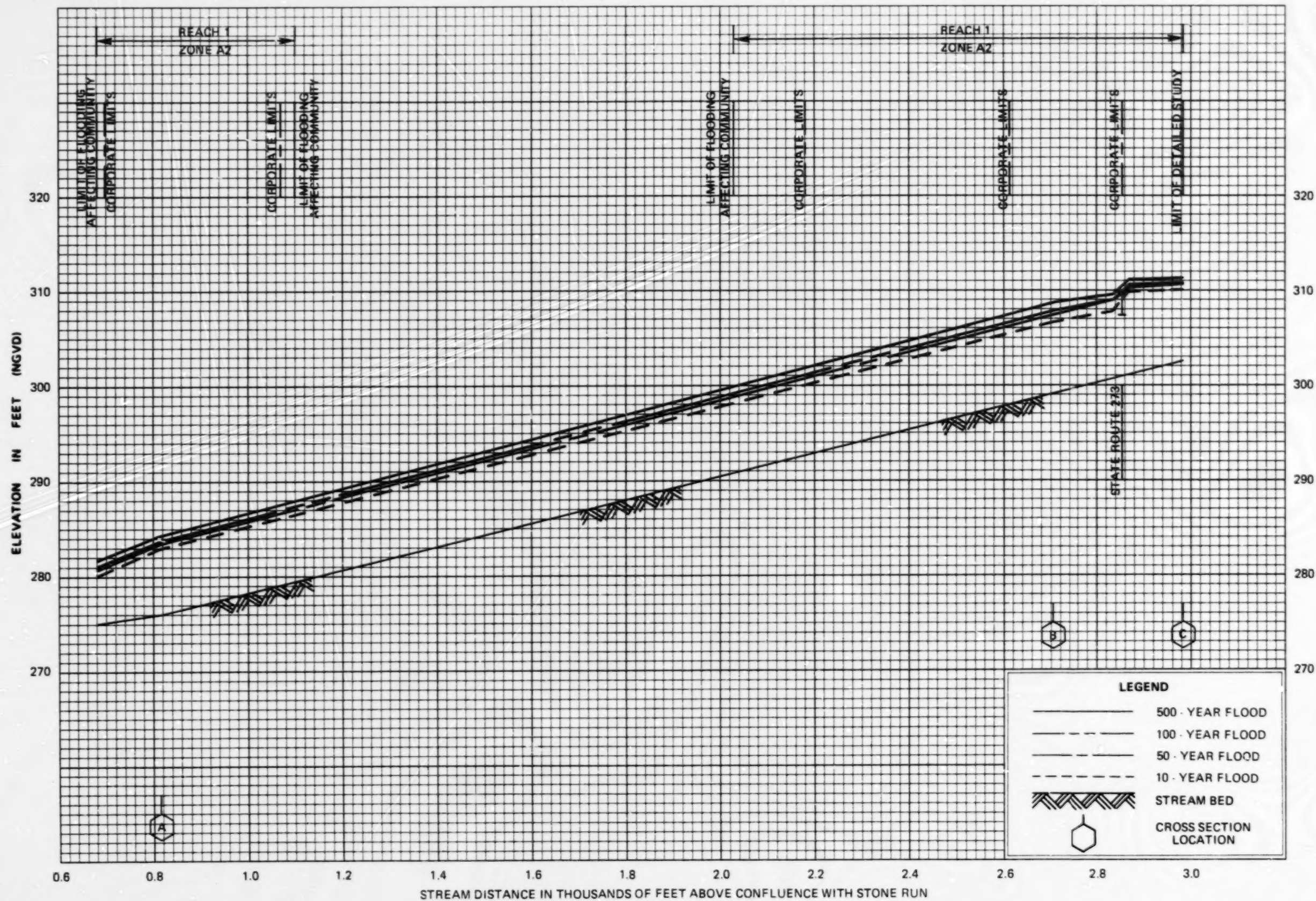
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF RISING SUN, MD

(CECIL CO.)

02P

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TOWN OF RISING SUN, MD
 (CECIL CO.)

FLOOD PROFILES
STONE RUN TRIBUTARY 2

03P

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